The American Biology Teacher

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Teaching Classification . . . Rooting Boxes

. . . Health Education . . . Summer Camps

THE AMERICAN BIOLOGY TEACHER

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The American Biology Teacher is a service publication of the National Association of Biology Teachers, teaching the life sciences from elementary grades through college.

The American Biology Teacher is indexed in the Education Index.

COVER PHOTO

Mr. Charles Walcott, 81 Sparks St., Cambridge, Mass., is responsible for another beautiful cover photograph. An adult male Cynthia moth is looking straight at you showing his large feathery antennae which differentiates him from the female of the species. This was taken with a Praktiflex on Plus-X 1/5,000 at f16.

NOTICE

By action of the Executive Board of the NABT, Dr. Richard Armacost, Division of Biological Sciences, Purdue University, West Lafayette, Indiana, and Mr. Paul Klinge, 246 Ohmer Avenue, Indianapolis 19, Indiana, have been appointed Co-Editors of the ABT beginning with the October issue. Manuscripts and material for publication should be sent to either of the Co-Editors. The Purdue address will constitute the official address of the journal relative to editorial matters.

THERE ARE FOUR PLANT PHYLA!

GEORGE GREISEN MALLINSON, Western Michigan College of Education, Kalamazoo, Michigan and
JACQUELINE V. BUCK, Grosse Pointe Public Schools, Grosse Pointe, Michigan

INTRODUCTION: In the October 1953 issue of *The American Biology Teacher* there appeared an article[1] which gave evidence that the teaching of certain topics and understandings of botany to students in high schools and colleges was not being optimally accomplished. Shortly after the appearance of this article, the author received several suggestions that he make some positive recommendations for correcting the deficiencies he described. This report, therefore, will outline one way in which the topic of classification may be taught more effectively to high-school students.

PRELIMINARY STUDY: Obviously, in any well-run biology classroom units of subject-matter are not mutually exclusive. Thus, if high-school biology is to be meaningful the units will be integrated so as to illustrate the continuity and interrelationships of biological principles among them. Hence, any study of classification should be preceded by materials that deal with the distribution of life in air, soil and water, and on the earth's surface. These materials should emphasize also the ecological relationships among plants and animals and their environments and stress the limitations on the types of life that can survive most effectively in certain regions and areas.

Without such introductory material any study of classification will be relatively meaningless.

LABORATORY WORK FOR THE STUDENTS: Probably any study of classification is doomed to be somewhat ineffective if the teacher introduces the subject by stating, "There are four (or ten) phyla into which all plants (or animals) fall." Such a statement fails to indicate that the numbers of phyla are matters of expediency and convenience rather than matters of absolute fact. Who knows how many phyla there might be if someone other than Linnaeus had provided the foundations for classification?

Such an error can be avoided by following these steps:

Step I: Have each student bring to class at least one peck bag of plant material. Caution the students to obtain all types of material, rather than restricting the collection to house plants. Provided the diversity and distribution of plant life has been studied prior to this time, this should prove to be no major problem. The contents of the peck bags should be dumped in a pile on the floor and "mixed thoroughly."

Step II: The class should then be divided into small groups, perhaps three or four students in each. This may be accomplished by means of the sociometric[2] or some other technique. The "pile" of plant material is then apportioned among the various groups. They are then given these instructions: "Let us assume that we want to study some of the characteristics of the plant material you have just received. In order to do so we will have to separate it into piles so that similar materials can be studied together. Your first job will be to separate your materials into a number of piles, placing similar plants together. You can separate them any way you choose. O.K.—let's get going."

Step III: Obviously no teacher can expect that all the groupings performed by the students will be phylogenetically correct. However, at this stage the correctness of separation is relatively unimportant! It is important only that the students develop some system for separating the material. The teacher should visit each group and urge that a system be established.

After twenty or thirty minutes have been devoted to this activity (with the help and inspection of the teacher as she moves from group to group) a class discussion is held. The emphasis of the discussion should be placed on the factors that the students considered in separating the material. It is likely that the consideration of structural similarity will be mentioned. If not, the teacher should see that it is.

By this time the period is likely to be over, and the teacher may suggest that the students

[1] Mallinson, George Greisen, "Knowledges of Botany Possessed by High School and College Students." *The American Biology Teacher*, XV (October 1953), 151–3.

[2] Moreno, Jacob L., *Who Shall Survive?* Washington: Nervous and Mental Disease Publishing Co., 1934. Pp. xvi + 440.

think over their activity and try to determine how they might have separated their plant material more effectively. It is ordinarily not desirable, at this time, to assign textual reading or to show a motion-picture film on classification, since most of these sources are likely to express the "pigeonhole" idea of classification and hence destroy the theme the teacher is trying to develop. The textbook and film may best be used as a summary for the study.

THE TEACHER'S DEVELOPMENT: On the day following the students' laboratory work, the teacher may follow this plan of development:

1. A brief review is held of the results of the separation process. In addition, the teacher may have the students suggest possible ways for improving the methods they used.

2. The teacher should then make clear that the different species of living things number well over a million. Thus it is self-evident that if living things are to be studied, they cannot be studied *in toto* but must be separated into "bite-sized" groups that can be studied conveniently. Classification is the process by which the separation is accomplished and the groups and their members are assigned names.

3. The next phase is crucial. The teacher should here indicate that the first separation of living things is obviously into two vast kingdoms, the plants and the animals.

She should then select one of these kingdoms and indicate that the members range in complexity (among animals, for example) from the very simplest one-celled organisms to the most complicated of all organisms, man. It is possible, therefore, to arrange the animals on the basis of structure on a continuum; namely, on one end the simplest one-celled organism, followed by the next most complex animal, and so on, until at the other end is man. In order to study animals, the continuum just described is divided into a number of groups (I, II, III, etc.) by setting up more or less arbitrary fences. See Fig. 1. The fences are placed so as to group those individuals whose structural characteristics tend to be most alike. The groups thus established are referred to as phyla (singular: phylum) and are given names to distinguish them from one another. Although the characteristics of the members of any one phylum are fairly similar, their characteristics are not necessarily dissimilar to those of certain members of other phyla. In fact, it is desirable to indicate that an individual at point B in phylum I (see Fig. 1) may be more like individual C in the next phylum (II) than like individual A in phylum I. However, individual B is more likely to be closer to the average of the individuals in phylum I than to the average of the individuals in phylum II. Hence, the position of individual B in phylum I is justified. When a new species is discovered, it may be difficult to place it in a particular phylum since its characteristics may fit more than one. However, it is placed in the one in which its characteristics are closest to the average.

By this time the students should realize that the statement, "every animal has its place," is a fallacy. Rather, animals differ from one another and are placed in the group to which they most logically belong.

EXTENSION TO UNDERSTANDING SUB-GROUPS: Once the idea of separating the animal (or plant) kingdom into phyla has been developed in the manner indicated, the process of separation into sub-groups is relatively easy.

Here it should be stated that even the members of just one phylum are far too numerous to be discussed *in toto*. Hence the same system for separating the animal or plant kingdom into phyla is used for separating the members of a phylum into sub-groups. The separation into sub-groups can be diagrammed as in Fig. 2.

It should be indicated here that as the breakdown into sub-groups becomes more and more specific, the animals (or plants) are more and more similar and hence are harder

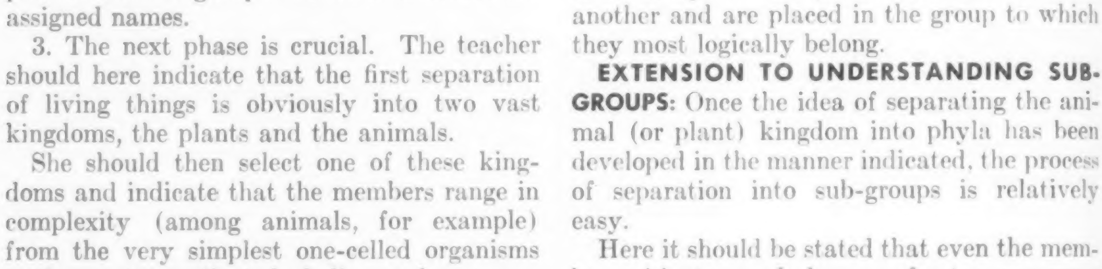

Fig. 1.

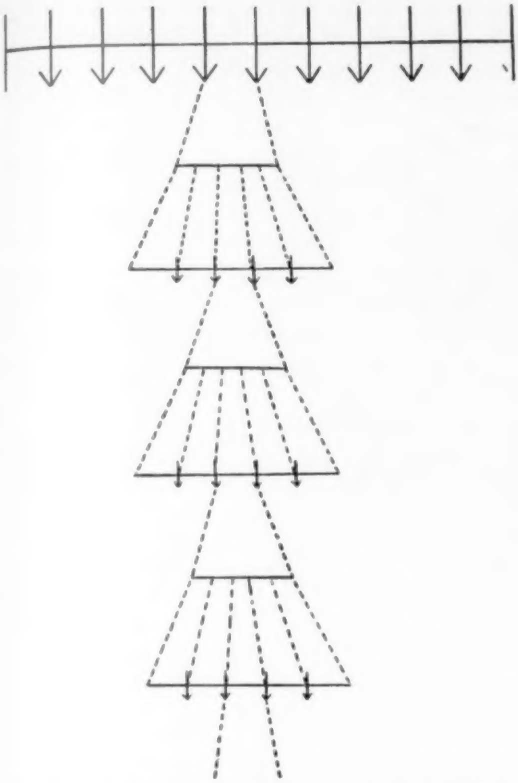

FIG. 2. Phyla divided into classes, but since there are too many in a class, it may be broken down again into orders, etc.

to place (or classify). It should be made clear that when a new animal (or plant) is discovered, its assignment to a phylum is ordinarily not too difficult, since the differences among the averages of the characteristics of phyla are fairly great. However, since the differences among the averages of characteristics of the sub-groups are small, the assignment of the new animal (or plant) to a "proper spot" is frequently a matter of a great deal of scientific controversy. Further, animals (or plants) are frequently removed from one sub-group in which they have been assigned initially and are assigned to another. The teacher should indicate that this is not analogous to placing a letter in the wrong mail slot, but rather to placing an individual in the wrong position in a line because of improperly estimating his weight.

This methodology should ever dispel the conviction that a teacher has when she states, "There are four plant phyla!"

Readers of Prof. Bonner's paper, "On Understanding Biology," which appeared in the April issue of ABT, will be interested to know that it will be included in a forthcoming book by Prof. Bonner.

HOW SOME PLANTS AVOID WINTER-KILLING

O. E. JENNINGS, Director Emeritus, Carnegie Museum, Pittsburgh

Birds and bears may migrate to a warmer clime or hole-up in a cozy den for the winter, but plants like trees and trilliums must make the best of it where they are. However, such plants do have ways and means of protecting themselves to a considerable degree against the rigors of our northern winters.

The living matter, or protoplasm, of plants often contains as much as ninety per cent water. Most annual plants die at the end of the growing season, excepting for their seeds. The seeds of our northern plants are mostly dry, the protoplasm containing only a few per cent of water, and they are usually further protected by impermeable seed-coats, or waxy, resinous or hairy coverings, all to the effect of keeping water out of the seed, and yet to retain enough water to keep the seed from a fatal drying out.

Unless caught by a premature frost, our northern deciduous trees and shrubs withdraw most of the useful food materials into the woody part of the plant in the fall before the leaf is shed. Another point to be noted is that as the soil becomes cooler with the approach of winter, lesser amounts of water are absorbed by the roots and, were the leaves still actively evaporating water, the plant might thus seriously suffer from the lack of water. Thus, the early shedding of thin leaves with a large evaporating surface is essential. It may be noted that with the shedding of the leaf even the leaf-scar on the twig is nicely waterproofed.

For perennial herbs like wild ginger and the bloodroot the bud which is to continue the growth of the plant next season is at the surface of the ground, or just below, where the mulch of dead forest leaves, snow, etc., gives it a protective blanket; so, also, with plants like the asters and goldenrods where next year's buds are clustered about the base of the stem. Many plants like the lilies have their next year's buds still deeper in the ground.

With trees and shrubs, where the buds are on the twigs and freely exposed to the whipping, drying gales of winter, evaporation of water is a serious affair. Most of the buds of our northern species are small, very compact, usually closely covered with overlapping,

tight-fitting, water-shedding scales, and often still further waterproofed by resin, gum, or hairy coverings, so that, as with seeds, unwanted water is kept out and still enough retained to keep the bud alive. The cells of many buds are also rich in food materials like sugars which still further lower the freezing point.

Broad-leaved evergreens such as the mountain laurel have usually leathery leaves with firm, rather dry texture, or like the rhododendron, have thick, fleshy leaves which can stand freezing, but do not permit a too rapid evaporation of water when they thaw. The leaves of the rhododendron are closely inrolled during the freezing weather.

Most important of all, however, is the fact that plants vary so greatly in "hardiness," their inherent ability to stand cold. Some tropical plants are killed by temperatures even several degrees above the freezing point, while arctic plants survive temperatures far below zero. As every gardener knows, many plants may be hardened off by subjecting them to successively cooler conditions.

Seeds of holly plants grown in Long Island will produce hardier plants than will seeds of the same species from plants grown in the South. It is quite probable that since the retreat of the ice from our northern states at the close of the Glacial Period many of our plants have been gradually extending their range farther north and at the same time becoming more hardy.

LOCATING THE SETAE OF THE EARTHWORM

EDWARD J. STOLT, Scotch Plains High School, New Jersey

The laboratory study of the earthworm usually involves the identification of the setae. Quite frequently all that is required of the student is that he feel the presence of these little bristles by rubbing his finger lightly over the surface of the worm. A good exercise in observation, however, is having the students determine the number and position of the setae on a representative segment. Hints may be given as to the total number, number of pairs, or general location of the setae depending on the ability of the pupils or the time allowed for the exercise.

The use of magnification, such as is afforded by a hand lens or a binocular microscope, is the usual means for positive identification of the setae. Another method, however, may be used either to supplement the other method or to serve as a good demonstration. First, make sure that the surface of the earthworm is dry in the area to be worked on (the posterior segments are usually the most satisfactory ones to begin with). Second, remove the coagulated mucus with the fingers by rubbing back and forth a few times over the body of the worm. Finally, stroke lightly back and forth over several segments with the side of the point of a freshly sharpened pencil. It will be noticed that the "lead" dust will be scraped off by the setae and will collect on the extended setae or in the pores of the retracted setae. A double row of little black dots may be seen. Continue stroking with the pencil, at the same time rotating the worm so that the entire surface of several segments has been treated in this manner. The location of the four pairs of setae on each segment will thus be made obvious (Fig. 1).

Fig. 1.

As an aid in locating the setae in their proper orientation to the various surfaces of a segment, pins may be used. Since the mid-dorsal line is easy to ascertain due to the presence of the dorsal blood vessel, a pin may be inserted through the mid-dorsal line to extend through the mid-ventral line. Another pin inserted through the same segment at a right angle to the first pin, and through the mid-lateral points, will divide the segment into quadrants. Proper orientation of the setae can now be accurately and easily determined (Fig. 2).

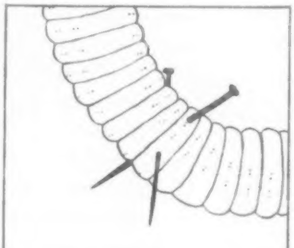

Fig. 2.

"Training the Conservation Worker," a 7-page leaflet reprinted from the AIBS Bulletin, can now be obtained from Dr. Richard Weaver, P.O. Box 2073, Ann Arbor, Michigan, at 10¢ each with discounts for orders of over 100.

Construction and Use of a Rooting Box

THOMAS COY, South Miami Elementary School, South Miami, Florida

This is a description of a science project based on plant life, adaptable to all grade levels. An important characteristic of any plan for a project is flexibility. All learning experiences must be adapted to your particular situation. One method of assuring yourself that they are properly adapted is to provide for pupil participation in suggesting problems, choosing words to be studied, and naming topics for discussion. Pupil participation in planning enables the teacher to sense what the pupils need to know in order to make their activities more meaningful.

Timing is also important in adapting learning experiences to your particular situation. For example, early in the project pupils may wish to discuss "reasons for having a rooting box." Perhaps, they would rather "skip that" and talk about making the box. Certain discussions listed, therefore, may be completely omitted.

As I gathered materials to construct the rooting box, I set up the following objectives for my project problem:

1. To plan and present a project adaptable to all grade levels, centered around construction and use of a rooting box.
2. To suggest teaching techniques, experiences and opportunities for learning and practicing basic language, number and other mental and physical skills.
3. To plan to continue this project during the coming school year, not only to attain the above two stated objectives, but also to help beautify the school grounds.
4. To develop attitudes that will encourage pupils to practice wise use of materials in daily life.

Presenting pupils with opportunities to learn through actual experience is an outstanding advantage of the rooting box, but it also possesses certain advantages within itself. They might be termed the basic reasons for having a rooting box:

1. A slip of a plant inserted in a rooting box, then transplanted, will require much less time to grow and bloom than a seed planted in the ground. A geranium planted from seed requires from eight to twelve months to grow and bloom. But a geranium slip inserted in a rooting bed and transplanted may bloom in two months or less.
2. A slip of a plant inserted in a rooting box stands a better chance of reaching maturity and blooming than seed planted in the ground. When you reduce the time element required for maturation, you automatically reduce the number of dangers and hazards to the plant.
3. The propagating box can be used to root hybrids and seedless varieties of plants.
4. When you plant a slip in a propagating box, you know what you are going to get. The seeds you take from a packet and plant may not always produce the beautiful flowering plant pictured on the packet.
5. A slip of a plant transplanted from a rooting box has developed already a strong root system which the seed does not possess. "A plant is as strong as its root system."

Materials for a Rooting Box

The dimensions for the box will vary according to your need; your construction costs will vary accordingly. Here is my list of materials and their costs: Cypress lumber, 1″ × 6″, 12′ length (**$2.00**); Nails and staples (**20¢**); Hardware cloth, ¼″, 2′ × 3′ (**62¢**); Small bag of charcoal (**30¢**); Terralite, two 3-lb. bags (**$1.80**); Peat moss, much more than I needed, so I marked this up to inexperience (**60¢**); 3-gallon bucket of sand; Wire brads; String; Four cement blocks; Burlap. Total cost: **$5.52**. (Fig. 1.)

Remember this! If in driving your staples to secure the hardware cloth to this surface, you drive them with the points placed across the grain, instead of parallel with the grain, there will be less danger of splits.

Media for the Rooting Box

These materials form the media in which the plant slips are inserted to develop root systems. Sizes of burlap and quantities of other materials will vary according to box dimensions.

1. Burlap is first placed in the bottom of each compartment. The combined dimensions of the two pieces of burlap should equal those of the hardware cloth before it was turned up flat against outside of the box. This will allow the burlap in each compartment to be

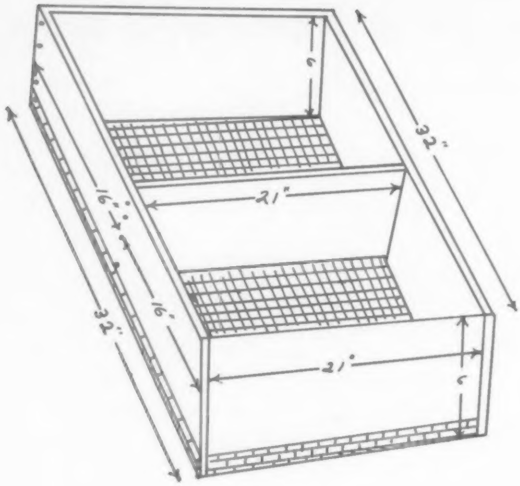

Fig. 1.

turned up on the inside of each compartment to a height of approximately 2 inches all the way around. The burlap is a base for the charcoal. It prevents the finer charcoal from falling through the ¼" mesh of the hardware cloth.

2. Charcoal should be pounded up into small pieces to make it spread evenly, forming a thin layer over the burlap. No piece should be bigger than a marble. Charcoal can be pounded with a minimum of waste: put it in an old cloth bag, then strike the outside of the bag with a hammer or sledge. The purpose of the charcoal is to reduce growth of fungus and bacteria that are harmful to plant slips. Charcoal also aids drainage.

3. Terralite is a commercial trade name. Terralite and vermiculite are synonymous. The purpose of Terralite is to hold moisture and afford a loose medium for growth of root systems. This looseness affords easier diffusion of oxygen from air to medium.

4. Builder's sand is needed for proper drainage. Amount needed will vary with dimensions of rooting box.

5. Peat moss is to build up acidity. Plants need certain elements in order to live. Assimilation of these elements by plants in the rooting box is best when a certain degree of acidity is present. Peat moss produces this condition. Peat moss also aids in holding moisture.

How to Moisten the Media

1. On day preceding insertion of slips, moisten media thoroughly. Sprinkle slowly, do not pour. Quantity of water used will vary according to volume of box. For this first moistening I used two gallons of water in each compartment.

2. On day of inserting slips in media, moisten slightly after insertion. Thereafter, sprinkle when necessary.

3. How do you tell "when necessary"? Stick your finger down into the growing medium. If it feels cool, it contains enough moisture. It it feels warm and dry, it needs moisture. If there is more than one medium, test media separately. Media vary in ability to hold moisture.

4. When moistening, always sprinkle entire surface area, in a single given medium, even though certain areas may be unoccupied by slips. Thus are unoccupied areas always prepared for immediate insertion of new slips brought by pupils and friends. Moreover, unsprinkled areas would absorb moisture from the sprinkled areas, possibly depriving the roots of needed moisture.

5. The rooting box should be set in a shady spot. Under each corner should be placed a cement block. Raising the rooting box enables it to drain properly.

Purpose of the Two Media and Number-Letter System

Plants can be divided as those of "new growth" and those of "old growth." Slips taken from plants or parts of plants that have grown during the present growing season are "new growth." Those before the present growing season are "old growth."

The slips from some species of plants root better if they are taken from "new growth." The slips from other species root better if they are taken from "old growth." Henceforth, the term "similar growth" will be used to designate slips taken from "new growth" alone, or slips taken from "old growth" alone.

Dividing the rooting box into two compartments enables us to separate the two rooting media; namely, (a) Terralite, and (b) Terralite–peat moss–sand mixture. By inserting a given variety of slips of "similar growth" in

The author takes a simple gardening procedure and shows how many teaching possibilities there are in it, especially for the elementary schools. This is a contribution of the NABT Conservation Project developed at Florida State University under the direction of Dr. Malvina Trussell.

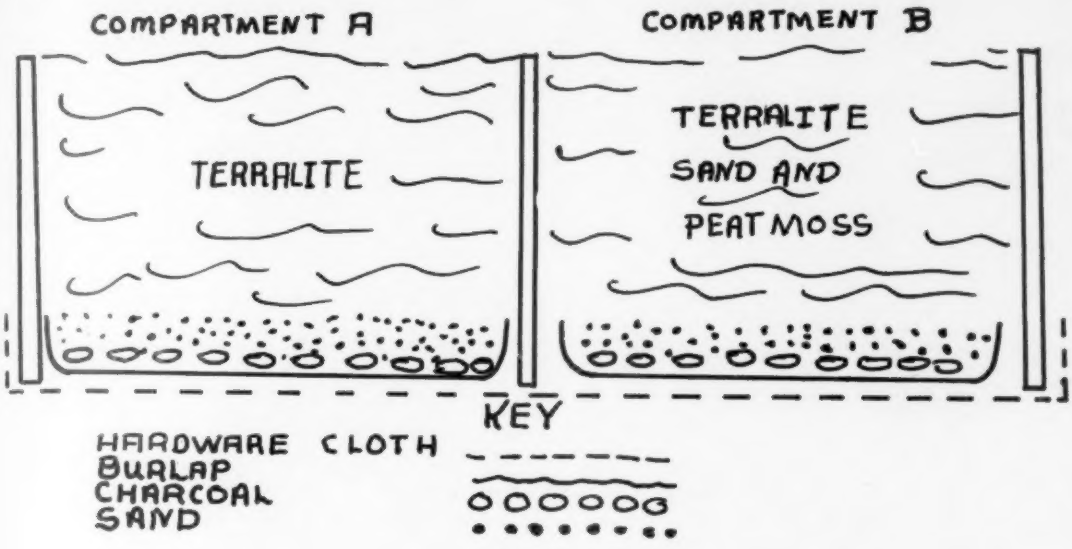

FIG. 2.

each of the two different rooting media, we learn which medium is the better one for developing root systems of that given variety. (Fig. 2.)

The slips I inserted in my rooting box were all "new growth." When slips of a given variety inserted in one compartment lived, and the slips of the same variety inserted in the other compartment died, it indicated that the medium of the first compartment was the better one for that particular variety. Increasing the number of slips inserted would increase the validity of results in this procedure.

When the slips of a given variety died in both compartments, I might assume, with reservation, that the growth from which they were taken was not that one most conducive to rooting that variety. Likewise here, increasing the number of slips inserted would increase validity of results.

This suggests a worthwhile project. A single medium, known to be conducive to the growth of a number of given varieties, is employed. Slips of both new and old growth of each of the given varieties could be inserted. Remember that validity of results increases with an increase in number of slips inserted for each variety. By this procedure it could be determined whether the "new growth" slips, or the "old growth" slips are better for rooting a given variety.

Small nails are driven upright, part way into the one-inch surface of boards. Two inches is the approximate distance between nails. Strings are drawn across length and width of box and tied to the nails, thus dividing the surface of the media into a number of small spaces. Each space has an area of approximately four square inches. Each of these small areas has a letter-number symbol.

Transplanting

After inserting slips and watching them grow, pupils will look forward to transplanting them. How will they know when the slip has developed a root system that will enable it to grow and bloom when transplanted? Usually, by the time several new leaves have developed and matured, the slip has developed a root system and is ready to transplant.

The next question boys and girls will ask is "How do you transplant the slips?" This is a worthwhile question. There are several things to remember in answering it:

1. Plant the slip in the soil to the same depth as you inserted it in the rooting box. (Levels 4, 5 and 6 in Fig. 3 beneath the soil.)

2. Put enough sand around the roots to cover them to the ends. If roots are very long, make a circular motion of the plant between your fingers, while roots rest in sand. This will serve to compress the root system, so to speak, so that it is entirely covered by the sand, like winding string on a stick. (See explanation below.)

3. Slips should be transplanted to a shady spot.

4. Slips should have plenty of moisture. Sprinkle foliage as well as earth around plant. Keep moist, but not soggy. Provide adequate drainage. Poor drainage results in rotting of roots.

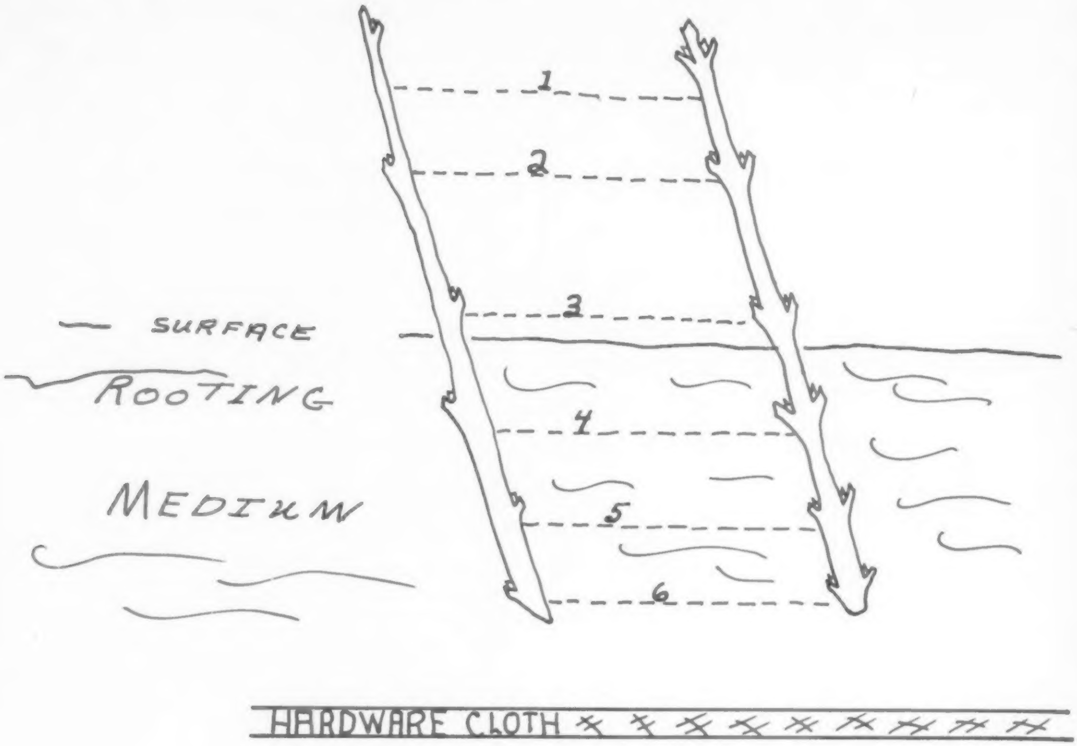

Fig. 3.

5. Soil around slips should be loose.

Sand is placed around roots of the plant to enable the plant to gradually become adapted to a change in soil conditions.

The time required for a slip to develop a root system varies according to the variety of plant from which it is taken. An experienced nurseryman told me that certain varieties of the Azalea plant root in eight to ten weeks. Cuttings from "old growth" Ixora require from six to eight months to root.

Additional factors which influence root development are health of cutting, temperature, moisture, rooting medium used and time of year. The use of hormones will speed up root development in some cases.

Conclusion

The following assumptions can be made:

1. As a whole, the Terralite-sand-peat moss mixture was more favorable to life and growth of cuttings than the Terralite alone.

2. A factor in the death of many plants in the Terralite medium was its ability to retain more moisture than was favorable to their growth. During the first two weeks after insertion of cuttings the Terralite always seemed to be more moist than the Terralite-peat moss–sand mixture. Several cuttings died in both compartments during that time. But more died in the Terralite medium than in the mixture medium. During the third week after insertion of cuttings there were several heavy rains. A few plants that had lived up to that time in the Terralite died. All plants living at the time of heavy rains in the mixture medium continued to live. Stems of cuttings in the Terralite medium that died during the heavy rains were black and rotted from *surface* of medium downward.

3. Some cuttings that died may have lived if they had been taken from "old" rather than "new" growth.

4. It is better to determine the state of a cutting's development by the healthy green appearance of its leaves than by removing the cutting from the medium. I pulled up a Mallow cutting that appeared to be in a healthy condition to examine its root development. A single root about one inch in length had grown. But the cutting died after being reinserted. Next to it, a Mallow which I did not remove for examination, continued to live in an apparently healthy state.

Outstanding factors which should be considered in viewing the above assumptions are:

1. Possible injury to cuttings in cutting, trimming and inserting them.

2. As a whole, there was not a sufficient number of cuttings of each variety to make results valid. Increasing the number of cuttings inserted to represent each variety would increase validity of results for each variety.

Further research is needed. An increase in number of cuttings of each variety and a selection of cuttings from "old growth" are two fitting opportunities for future experimentation.

Suggested Learning Experiences

Number Experiences: 1. Figuring dimensions and divisions of box and compartments. 2. Problems based on area and volume. 3. Problems based on weights of materials. 4. Problems based on comparative weights of materials per unit volume, as sand and Terralite; charcoal and peat moss. 5. Figuring cost of materials. 6. Discussion of economy in quantity buying.

Language Experiences: 1. Learning spelling, pronunciation and meanings of new words necessary to carry on discussions and for use in written composition. 2. Class discussions at various stages of project. 3. Written composition. 4. Experiences in giving and taking oral and written instructions. 5. Research through reading.

Science Experiences: 1. Research and observation through actual experience: (a) Correlation between rooting media and root development. (b) Correlation between age of slip to be rooted and root development. (c) Relation of plant growth to soil composition. (d) Relation of plant growth to moisture conditions. (e) Relation of plant growth to amount of sunlight and shade. (f) Relation of plant growth to temperature. (g) Experiment with removing various numbers of leaves from slip to determine proper defoliation, according to plant variety and area conditions. 2. Discussions: (a) Reason for cutting slips on slant. (b) Importance of leaving buds uninjured. (c) Reason for having more than one level (bud) below and more than one above surface of medium. (d) How properties of charcoal, peat moss, Terralite are utilized in rooting box.

Other Experiences: 1. Setting up and reading graphs and charts. 2. Keeping detailed records. 3. Evaluating data and drawing conclusions. 4. Developing a sense of responsibility where results are suspended. 5. Making graphic illustrations (drawing). 6. Manual skills involved in construction of box and trimming slips.

Some Lesser Known Career Opportunities in Biological Sciences

DOROTHY E. ALFKE, Pennsylvania State University

For young people interested in biological sciences information about some of the lesser known related fields of work seems needed. The various types of laboratory and field research in government conservation agencies, museums, botanical and zoological gardens, and colleges and universities are becoming crowded fields. Yet the agencies mentioned have positions in library, statistical or interpretive work for which adequately trained personnel is difficult to find. Young people interested in natural science might profitably consider these related opportunities in the light of their own interests and aptitudes. In these some may find a challenging vocational goal.

Many agencies such as museums and conservation agencies are placing greater emphasis on the importance of interpreting their work to the public, both as a recognized service function of the institution and as a means of enlisting the public cooperation so necessary for the success of their programs. This creates a need for persons well trained in the related science subject matter and in one or more areas of interpretation. Some of the positions might be described as follows:

An editor of a state conservation department is responsible for the production of a quarterly magazine for laymen, supervises the production of pamphlets and news releases, handles some of the correspondence inquiries from the public and often presents talks to school groups or adult clubs.

A woman employed as a public relations staff member in a state game department has responsibilities which involve editorial and journalistic work, radio program production and participation, publicity work, movie scenario and script writing and handling of corre-

This is the second of Dr. Alfke's four articles on vocational opportunities in the biological sciences. The remaining two will appear in the fall numbers of the journal.

spondence. She also works with various camp groups and helps prepare exhibits for the department. She does a considerable amount of illustrative work, including some photography.

These two are mentioned as being representative of the positions in the increasingly important field of interpretive work. Many of these positions are largely what the individuals in the position makes of them and depend on the interests and abilities they bring to it. At present many persons thus employed are not formally trained for the work. Often a person with the subject matter training is employed, and he or she develops the editorial, public speaking and other skills on the job. In other cases, a person with editorial or journalistic training in an unrelated field receives on-the-job subject matter training. However, there is a growing need for personnel specifically trained for these interpretive positions. Employers are seeking candidates with interpretive skills and training and subject matter background. It is encouraging that a few colleges are now developing curricula for the preparation of young people for these important informational positions.

Another type of work somewhat related to the preceding is that of editor of technical literature. Biological research agencies often employ one or more persons to edit their publications. The duties include such activities as proofreading and rewriting, checking articles for correct English usage, typographical errors, readability and sometimes scientific accuracy. In some positions the technical editor does most of the writing of the material.

Several fields of work related to biological sciences provide limited opportunity for careers. These include creative writing, creative drawing, technical illustration, still and motion picture photography, radio and television production and exhibit preparation. Many of our best known workers in these areas are in positions for which such activities are only a part of their total job. Few people are working full time to earn a living in any of these fields. However, anyone interested in a career in natural science should develop any abilities along these lines so as to be prepared if opportunities should present themselves. The possession of skill and training in any of these areas may give a candidate a strong advantage in seeking a position in research, editorial work or other jobs.

Most agencies engaged in biological research have an increasing demand for staff members with training in statistics as well as in the related science subject matter. Here again is an area in which the natural science training is not always required but is preferred to the extent that persons with both statistical training and subject matter background are available. Positions range from the top level statisticians with training at the Ph.D. or master's level to those of statistical aides or assistants for which one might qualify with some basic statistical training. The latter could be considered as toehold positions for persons interested in moving into other types of work in the biological field as well as beginning positions in biological statistical research. Fully trained statisticians plan and supervise the gathering of statistical research data and are responsible for the interpretation of the results. This means close contact with other phases of biological work and often involves considerable field work. A science-

Staff member Dalton E. Merkel of the California Junior Museum, Sacramento, with Foxy the gray fox, visit Keith Hacker who is in bed because of a traffic accident.

minded person might well find this type of work challenging if informed of the opportunities.

Many museums, state and federal conservation agencies, botanical gardens, science departments in universities and other biological research agencies maintain libraries for the use of their staff and for interested outsiders. These provide positions in which a person, particularly young women, with a natural science interest might find great satisfaction. A librarian with degrees both in forestry and library science states, "By combining a love of forestry with a love of books and research investigation, I have found a job in which I have more to do with actual forestry than many top forestry administrators do." Here is an opportunity for one to work continually with the literature of a field of interest, to cooperate in research projects and to enjoy continual professional contact with workers in all phases of work related to the agency served by the library.

Natural science as a form of physical therapy is a challenging field in which little work has been done. Some small-scale efforts have been made along this line. Several museum workers have taken museum exhibits, live animal and nature activity projects into hospitals for physically handicapped or mentally ill patients. One psychiatrist has used shell study as a planned form of therapy with some of his patients. Some physical and occupational therapists have used greenhouse or farm work, care of pets or other nature activities as part of their total therapy program. The success of small-scale pioneer efforts indicates that there might be a place in our therapy programs for the use of more extensive, carefully planned, natural science programs. Administrators of veterans hospitals, contacted by the writer, expressed the belief that a person trained in both physical therapy and natural science could make a valuable contribution to the treatment of the handicapped. A shortage of physical therapists exists. Therefore, an enterprising person, well trained in both areas, should have little difficulty finding opportunities to develop the possibilities of natural science as a form of therapy.

Most of the types of work discussed in this article suggest two aspects of employment in the biological sciences. Therefore, one might plan his or her training and experiences so as to be well prepared for the type of work preferred but also to qualify for some other phase of work which might serve as a toehold position. Thus, for example, one might qualify as a statistical assistant in a state conservation agency in the hopes of eventually being transferred or promoted into an editorial position. Since most of the employing agencies favor a promotion from within policy, such an approach may prove successful. With careful planning one should be able to increase not only his or her chances of employment in the natural science field but also his or her chances of success and personal satisfaction on the job.

AUDIO-VISUAL AIDS FOR BIOLOGY

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Audio-visual or multi-sensory aids to teaching probably are used in biology more than in most high school or college subjects. In schools that are not large or well financed, expensive or infrequently used aids are not practical. Teachers in such institutions must devise substitutes.

In our school we wanted to use the microprojector, with discussion, to aid classes working with microscopes. We found a way to do this without installing new projection or lighting equipment. Our table microscope lamps did not interfere with the students' vision of the picture projected by the microprojector. When the room was darkened, the lamps threw enough light on the tables for students to continue their drawing. For projection we chose slides that were almost identical with those used in the students' microscopes. The instructor can talk about specific items in the projected slide which correspond. If he wishes to make explanatory notes on the blackboard, fluorescent chalk makes these visible.

In a large lecture room, however, a microprojector will not give a clear picture for people in the back of the room. If it is used, lights for taking notes must be furnished by small individual lamps on all desks, or by narrow-focused ceiling spotlights, but this is expensive equipment for small schools.

Microscope table lamps may be used with the filmstrip and slide projector. Usually, the

film or slide should be a diagrammatic or graphic representation of what the student has under his microscope.* The same table lighting scheme can be used with an opaque projector in the laboratory. Actual photographs thrown on the screen by opaque projectors are often great convincers of the reality of the section under microscope study. They can be used to show whence the section was procured, or to emphasize its connection with the rest of the anatomy of the plant or animal seen in the photograph. With table lamps this can be done without interrupting the microscope work.

Some biology teachers have little ability to draw illustrations, graph or write while they are lecturing. Such teachers might put their material on blackboards before the class period. Often, however, classrooms are occupied by others preceding the lecture. When this was the situation in one of our classes, we made use of special student help in preparing teaching aids for the lectures. Student volunteers drew anatomical wall charts on cheap paper, large enough ($3\frac{1}{2} \times 5$ feet) to be seen at the back of the lecture hall. Similarly prepared were daily vocabularies, classification lists, and explanatory diagrams. These student-made aids were sometimes more useful than commercially prepared wall charts, because they were made to apply specifically to the lecture. Students constructing such aids not only receive extra credit, but their work helps them in their study. Copying pictures from textbooks is not considered good biology training; however, before the charts are made, students usually study the laboratory specimen and work with the instructor on it.

One student, a lad whose hobby was photography, made enlarged photos of dissected animals and mounted them on large wallboard for lecture use. He performed the dissections for his photographs. Another student made charts by using the microprojector and opaque projector to project photographs and slides on to large sheets of paper and tracing them thereon.

We use some manufactured aids along with the student-made ones. Thus, there is a wide layout of visual materials across the front of the classroom. In large rooms we have two or three duplicates of each chart placed around the room so that each pupil can watch a chart near him. This may not meet with the approval of the orthodox audio-visual expert, as they fear splitting of attention; however, if the pictures are duplicates, attention will be hard to divert.

Some faults found with wall charts drawn by students were: outline of figures were too dim; labels were printed too close to the drawn figures, thus obscuring them; printing was too large, too small, too dark, or too light; labeling did not emphasize the important parts of the drawing. For certain teaching purposes, a drawing should be without labels.

Student-constructed aids can also include models. Students can do good jobs of repairing and rebuilding models and learn much by such work, as well as supply teaching aids for the instructor. They are hardly capable of rebuilding the most valuable models, such as those of glass or transparent plastics, but they can repair, and even build, the plaster, wood, and pressed-paper ones.

The best biology teaching aids, of course, are the laboratory specimens, plants and animals, alive or preserved; however, they cannot always be used. It would be physically impossible to bring into the lecture room all the organisms studied. The best we can do is to bring in pictures, reproductions, and imitations of the real animals; i.e., audio-visual aids. To come as close as possible to a study of the real animals in their native habitats, we can use all possible aids. After visiting a mink farm, my class told me I might teach about mink by showing a movie of the animal in the wilds; at the same time, a stuffed mink would be passed around the class and atomizers on the walls spraying mink musk on the class. They forgot the sense of taste. Such suggestions might not be entirely ridiculous. Good usage might have several aids registering through the same sense simultaneously. For instance, a student might see the animal taught through a picture, a model, graph, diagram, and preserved specimen, all at the same time.

Various sound aids, also, can supplement each other. There are now available more sources of good sound aids in biology. Often, however, sound materials, such as bird songs, take up too much time in the ordinary course. The same fault is found with many movies; they take too much time for the teaching contained. A moving picture may teach many

* For laboratories that cannot be darkened, "daylight" screens with wings can make microprojection workable.

> **Editor's Note: Some good tips are given the busy biology teacher in the use of audio-visual aids to promote efficiency. The author points some ways to make the aids interesting as well as instructive for the student.**

facts simultaneously, such as size, shape, color, density, smoothness, grace, spirit, or behaviour habits of an animal. Verbalizing would require several minutes to give the same facts and would not present them as impressively; however, the point is—the facts the picture teaches may not be the ones needed for the lesson of the day, nor in the proper sequence for overall understanding. Students comment that some movies waste their time, and accuse some instructors of using movies to escape lecturing. The supply of good movies that really give technical information is increasing, as evidenced by the lists published in recent issues of the *American Biology Teacher*, such as the list of film showings at the St. Louis meeting, published in the April, 1953 issue.

In radio, frequency modulation has made it practical for colleges and universities to broadcast scientific instruction for other schools; however, here again too little of the material is pitched to the level of the high school and college. We need more for these levels. We need on-the-spot reports from research laboratories and instructional laboratories, or on-the-spot descriptions by explorers and biologists of flora and fauna of faraway places.

Television, of course, is a better medium for broadcasting such instructional materials. Mechanical difficulties of sending and receiving, at present, limit this to almost a near zero usage, but it has a high educational potential. The American College of Surgeons has successfully telecast surgical clinics from operating rooms to distant points.

The institution of the future may use mechanical devices to send college courses to students in their homes and workshops. A university, then, may be not only a campus, a place on the map, but a teaching presence permeating the atmosphere and spreading over the whole state which it serves. The Illinois University Dental School, for example, has used telephone hook-ups where clinics are piped out to 147 centers where dentists gather for instruction. A research biologist in Chicago by television may step into a laboratory in Vienna, where investigation identical to his own is in progress. Likewise, facsimile recordings might bring research data from distant laboratories as fast as they are set down by the instruments there.

Biologists, too often, tend to disapprove of all teaching other than the lecture and the orthodox laboratory investigation of real objects. They should liberalize their philosophy and change their teaching procedures to make use of all workable audio-visual materials. Research will continue to be the pulsing heart of the science, the source and foundation of its knowledge and power. Modern teaching with the use of aids will improve the groundwork of biological learning, and furnish more inspiration for research and expansion of the fund of knowledge.

HEALTH EDUCATION THROUGH BIOLOGY

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Health education aims at the conservation of the health of our most important resource—our boys and girls. American schools at the secondary level present to the pupils instruction in health with the wholesome aim that those receiving the instruction may be stronger, healthier, and happier. The subject matter is present in other courses; e.g., biology, the generally required course presented at the secondary level for the purpose of developing attitudes and concepts about living things. It is the purpose of this article to show some health topics found in current biology material and to present these topics as opportunities for teaching and planned integration between health instruction and biology.

Present Position of Health Education

How has health education emerged to its present position in secondary education? Man

has long recognized the relationship between health and other aspects of education. Juvenal in the second century A.D. summarizes the aim succinctly, " Mens sana in corporo sano." Since 1850 in America the steady trend in the recognition of the importance of health has set the stage for the teaching of health in schools. 1850 marked an important date in the field of public health and of education, for in that year came the publication of Lemuel Shattuck's *Report of the Sanitary Commission of Massachusetts* and the beginning of tax support for public schools.

In his report Shattuck presented a comprehensive public health program showing a remarkable grasp of the spirit of modern education. Tax support of public schools meant universal education which in time reached the children of all the people. In this favorable soil the seed of health education was able to root. As the Harvard Report points out, "The role of the school in the development of health may be decisive. Although first responsibility in this matter rests with the family and the community, in some places the schools must assume the task of giving direct instruction in health, personal and civic." [1]

Health is a state of complete physical, mental and social well being and not merely freedom from disease or infirmity.[7] Present day interest in health is worldwide.

Health was first selected as one of the Cardinal Objectives of Secondary Education in 1918, and the term "health education" was proposed for the first time in 1919 at a conference of leaders of health and of education called by the Child Health Organization.

In 1928, health education was defined by Dr. Thomas D. Wood of Columbia University, a leader in the school health movement, as "the sum of all experiences which favorably influence habits, attitudes, and knowledge relating to individual and community health."

During the quarter of a century in which health education has become an integral part of American education, the schools have been called upon to play an increasingly vital role in the preparation for a healthful life in a democracy.

The Joint Committee [4] has set down the aims of health education thus:

1. To instruct children and youth so that they may conserve and improve their own health.

2. To establish in them habits and principles of living which throughout their school life and in later years will aid in providing that abundant vigor and vitality which are a foundation for the greatest possible happiness, and service in personal, family and community life.

3. To promote satisfactory habits and attitudes among parents and adults through parent and adult education and through the health education program for children, so that the school may become an effective agency for the advancement of the social aspects of health education in the family and in the school itself.

4. To improve the individual and community life of the future; to insure a better second generation; to build a healthier and fitter nation and race.

Health education is broad in scope. It must be planned and coordinated into an orderly program based on three major areas—healthful school living, school service, and health instruction. Health instruction means teaching children in the classrooms and in all situations both by direct and by incidental methods, so that each child may learn, for example, the scientific basis for correct living as related to nutrition, clothing, exercise, rest, cleanliness, immunization, first aid, safety, sanitation, and the care and function of the human organism.

The development of health education, then, has been in accord with American principles stemming from the establishment of free public education. It is the opinion of many that biology, as it is now taught in the secondary school, can do much in furthering the worthwhile aims of health education.

In 1927, Dr. Lois Meier [3] made an investigation of the health material in biology, general science, chemistry and physics by an analysis of current textbooks. She analyzed four biology textbooks in common use and found about one-half of the material could be classified as health material. Material having to do with food placed first in space devoted to it, and disease placed second. Biology teaches the actual bases of all health habits, including the strongly advised indirect method of sex education.

Anita D. Laton [2] in 1929 made a study applying the facts and principles established by work in the psychology of learning to the teaching of one unit of subject matter in junior-high-school biology, where teaching was directed toward health education as an

objective, rather than toward mastery of subject matter.

This study falls into four parts: 1. The choice of specific health objectives and subject matter designed to contribute to these objectives; 2. Study of the relation of these objectives and subject matter to the subject matter and objectives of biology; 3. The choice and execution of teaching procedures; 4. The testing program carried on to see whether the specific objectives have been gained.

The unit on prevention and control of disease was chosen as the unit for experimentation. The diseases studied were those from which the student is more often required to protect himself. The choice of teaching material for the above unit emphasized prevention, not treatment. Knowledge of, and attitudes toward immunization, and not the method of inoculation were stressed. It is the preventive activities rather than the characteristics of a disease with which the health instruction program should be concerned.

Worick [6] found that out of a total of 2,011 items of health education from three biology sources examined that 191 of these were present in all three sources. From his study one may glean the following: In terms of the number of items of health education the 21 major topical areas may be ranked as follows: Disease 343; Food 296; Alcohol, Tobacco and Drugs 168; Community Health 156; The Circulatory System 121; Arousing a Desire for Health 102; First Aid 97; The Digestive System 88; Mental Hygiene 83; Personal Hygiene 77; The Endocrine System 63; Family Life Education 58; The Respiratory System 54; Eyes and Ears 53; The Excretory System 45; Air, Sunshine and Ventilation 43; The Nervous System 43; Exercise, Rest and Sleep 42; The Skeletal System 33; The Human Body 27; The Muscular System 19.

In view of the above data there seems to be no question as to the value of biology sources as a fertile field for health education material. If the biology information listed above could be taught with an eye toward proper health attitudes and practices, as well as for subject matter, the biology teacher would be making a great additional contribution to the health of our greatest natural resource—our boys and girls.

Recommendations

1. Biology teachers should direct their attention toward the health education material present in biology. This material may be taught with health objectives in view as well as for subject matter objectives.

2. Biology teachers should plan cooperative teaching with health educators.

3. While it is not recommended that biology take over the work of formal health classes, it may be that certain health topics are better taught in the field of biology.

4. Biology teachers and health educators should investigate the use of biology laboratory facilities for improved teaching of certain health topics.

5. Biology teachers and health educators should cooperate in the correction of certain misconceptions concerning health knowledge.

It seems imperative that health educators, biology teachers and school administrators meet frequently to coordinate instruction in health education and biology.

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"THE OLD FOSSIL"

At Wells Senior High School, Chicago

A new teaching tool is intra-tele, a closed circuit TV. Intra-tele consists of a specially designed twenty-pound camera, bread-box in size, equipped with medium, close-up, and telephoto lenses, attached to an inexpensive cable with a range of up to several hundred feet which connects to as many as ten ordinary TV sets. This intra-tele system may be used for any regular classroom recitation, experiment, dissection, school program or entertainment, which in turn may be piped to any other part of the building for special groups to observe.

You air-wise TV enthusiasts will be pleased to know The Chicago Educational Television Association will have offices and studios operating in a few months in one of the wings of Museum of Science and Industry. This activity in Chicagoland seems to be the most promising of any in the country.

Orvile Falk, ichthyologist, comments, "More aquarium fish are killed by over-feeding than in any other way. They should be fed every second day, and then only an amount they will consume in a few minutes. If the aquarium is well balanced the time between feedings may be lengthened to several days or even weeks."

"Sponsor Handbook," published by Science Clubs of America, 1719 N Street, N.W., Washington 6, D. C., is free to sponsors. It deals with general club information, organization, lists of projects and their outlines, and lists of affiliated clubs in various states.

A first-aid kit for books, consisting of ink and pencil erasers, transparent and cloth tape, and a bottle of glue, all stashed in a convenient drawer or shelf will add materially to the useful life of books. The erasers are for ink and pencil marks, transparent tape for torn pages, while cloth tape will hold front and back covers to front and back pages after glue has been applied to the book saddle and cover. Place responsibility for erasing and repairing with the students whenever the damage is found.

Your science department should develop its own system of consistent, foolproof, book identification. Books belonging to the school should be stamped with an identification stamp on the inside cover and again on some page, perhaps page 99. Individual books in a set should receive a volume number from a numbering stamp. Books may be more accurately identified with a page perforating system. Place your stamp pad, numbering stamp, identification stamp or page perforator in your school book first-aid kit for accessibility.

The lead strip binding aquarium plants together when they are shipped should be used in the aquarium with the plants. The strip or portions of it may be used to sink the stem ends of the floating plants into the water.

Place the wet pulp and seeds of fleshy fruits (tomato, melon, gourds, and others) on a strip of cheese cloth or bandage to dry for next year's plantings. After they are thoroughly dried, the cloth may be folded and placed in the proper container, labeled and stored. When labeling seeds indicate the kind of seeds, variety if known, source, and year-date.

The pamphlet, "Care and Feeding of Laboratory Animals," compliments of Research Laboratories, Ralston Purina Co., St. Louis 2, Missouri, explains the care for many kinds of animals found in the laboratory. Under each animal listed are given the various chows with ingredients, their chemical composition and how to feed the mixtures. In addition to being well illustrated, the pamphlet has a section devoted to diseases and parasites. It is worth a stamp for the trouble.

Because female rabbits are at a premium, Dr. Walter Ladwig, Elmhurst, Illinois, rabbit supplier for a live animal wholesaler, started selective matings from litters with a large female ratio. The female sex ratio has gradually increased to a significant figure near 80%.

Steps in setting up an aquarium are: Check the tank for leaks; add several lumps of charcoal for gas and odor absorption, then soil if desired, and cover fully with well washed aquarium gravel. Place a large piece of cardboard on the sand, and carefully pour the water on the cardboard, to a depth of a few inches. The root bearing plants may then be planted, and the remaining water poured on the cardboard which prevents eddy currents from disturbing other materials. Floating plants may be added at once, but the animals can be kept separate from the tank for a few days until the gases are absorbed. A glass plate over an aquarium top is desirable because it catches water of condensation, preventing evaporation and, at the same time, aerating the water by the return drip. The plate also keeps out ink, gum, paper, etc.

A balanced aquarium, in the true sense, will have a profusion of plant life, algae, protozoa, and aquatic animals. A balanced aquarium will have a clear transparency not present when it is first set up or when it is foul. There is a shifting of algae dominance during the seasons. One dead fish, clam, crayfish, or frog will foul an aquarium over a week-end, so you should inspect them on Fridays, but do not over-feed on that day as food will also foul the tank. A foul tank has a fishy odor, and the transparency becomes dull to a milky appearance.

Write your comments to "The Old Fossil," 5061 N. St. Louis Avenue, Chicago 25, Illinois.

Across The Editor's Desk

Brother H. Charles, President-Elect of the NABT, is in charge of a project to introduce NABT members to each other. He is investigating the possibility of a News Letter to take care of the items telling of the doings of members of the NABT which the ABT simply does not have room to include. Although Brother Charles is a man of great energy and ability this project will only be successful if *everyone* in the NABT helps out. He is in the process now of inviting such news. Send your Personals to Brother H. Charles, F.S.C., St. Mary's College, Winona, Minnesota.

The synthesis and testing of Azaserine, an antibiotic which is being studied for possible value against human cancer, was reported in a series of scientific papers by chemists of the Sloan-Kettering Institute for Cancer Research, New York, the Wellcome Research Laboratories, Tuckahoe, New York, and Parke, Davis and Co., Detroit, at the American Chemical Society's Division of Medicinal Chemistry at Kansas City. Chemical attack against amebiasis, a disease caused by infection with a parasitic ameba, was the subject of the opening symposium in the program.

A new microscope attachment which provides a 12.8 mm. working distance has just been delivered by its English manufacturer to Edmund Scientific Corp., Barrington 3, New Jersey, a regular ABT advertiser, and exclusive distributor in this country. The attachment, in two models, 20x and 40x, also erects the image viewed. Progress in many fields of research has been difficult because of the minimum space restriction between the objective lens of the microscope and the specimen. A great deal more freedom of movement is now possible in dissection, for example. The microscope can now be employed in viewing some surface defects and specimens at high temperatures. The system operates well under phase-contrast procedures, making it particularly suited in dissection. Additionally, the erect-image feature eliminates awkwardness in manipulation of specimens, since movements of the hand need not be reversed in relation to the image. The attachment will fit any standard microscope. It replaces one of the objective lenses, and revolves readily along with the other objectives in the nosepiece.

The University of Minnesota announces the establishment of an Institute for High School Teachers of Biology at the Lake Itasca Forestry and Biological Station this summer. Financed by the Fund for the Advancement of Education, the objectives of this institute will be to give high school teachers experience and training in field and laboratory biology under the direction and leadership of staff members of the biology station.

A stipend of $300 per student will be available for 20 persons. Minimum costs at the station are about $150. High school teachers will be selected on the basis of their present teaching program, aptitudes as indicated by scholastic records and teaching ability, and interest in teaching biology in the broadest sense.

Persons interested should write the Dean of Summer Session, 955 Johnston Hall, University of Minnesota, Minneapolis 14, Minnesota.

The eighth Paul B. Mann Biology Congress will be held at the American Museum of Natural History, New York, Saturday, May 15th. Featured will be reports and demonstrations of biology research by students in New York high schools.

The purpose of the Congress, sponsored by the New York Association of Teachers of Biological Sciences, is the stimulation of scientific thinking and activity among high school students, and the providing of an opportunity for those who have done individual work on biological projects a chance to present and discuss their achievements publicly. The Congress is non-competitive and students wishing to take part file application through their own school science chairman.

The University of Michigan announces a workshop on community–school camps, August 2–15, 1954. For more information write Dr. Elmer D. Mitchell, School of Education or Dr. Richard L. Weaver, School of Natural Resources, University of Michigan, Ann Arbor, Michigan.

A new master's sequence in conservation and outdoor education will be offered by the University of Michigan. For more information write to Dr. Harlan C. Koch, Graduate Adviser to the Michigan Colleges of Education, University of Michigan, Ann Arbor, Michigan.

This summer the Chicago Teachers College and the Cook County Forest Preserve District are again cooperating in a resident nature camp for eight weeks. During and at this camp four field courses are to be offered in the Natural Resources Sciences. For further information write: Chicago Teachers College, 6800 Stewart Avenue, Chicago 21, Illinois.

The Conservation Committee of the Garden Clubs of America, 15 E. 58th Street, New York 22, has prepared two excellent pamphlets on "Conservation," which tell simply how gardening can be a big factor in conservation.

Cornell University has bats in the basement—for research into the mysteries of hibernation. Professor William A. Wimsatt and his assistants are conducting year-round studies of physiological changes in the hibernating animals. Cornell's "batteries"

NOTICE TO CONTRIBUTORS

Manuscripts for publication in THE AMERICAN BIOLOGY TEACHER should be typewritten, on one side only, on standard white paper, $8\frac{1}{2} \times 11$ inch size, with a margin of at least an inch on all sides. The writer should keep a carbon copy for reference and as insurance against loss of the original in transit. If at all possible, illustrations should be obtained for each manuscript.

Articles are scheduled for publication in approximately the order of acceptance of the manuscripts. Generally the journal is tentatively arranged about three to four issues ahead, and there are under consideration at any time enough manuscripts for about two or three more issues. Some space is of course allowed for news items and articles of a seasonal nature. Many seasonal papers have to be postponed an entire year, simply because the author has not allowed the necessary four to six months that intervenes between acceptance and publication.

For details concerning titling, headings, references, illustrations, etc., consult *Preparation of Manuscripts for Publication,* which appeared in the November, 1949, issue of THE AMERICAN BIOLOGY TEACHER. A limited number of reprints is available; copies may be obtained from the Co-Editors or from the Secretary-Treasurer.

Manuscripts for major articles should be submitted to either of the Co-Editors or, to them, through any one of the Assistant Editors. Dr. Richard Armacost, Division of Biological Sciences, Purdue University, West Lafayette, Indiana, is a Co-Editor, and his address will constitute the official address of the journal on editorial matters. Home address of Co-Editor Paul Klinge is 246 Ohmer Avenue, Indianapolis 19, Indiana, and school address is Howe High School, Indianapolis 1, Indiana. Criticisms and suggestions will be welcomed.

Most issues of THE AMERICAN BIOLOGY TEACHER, except those of 1938–1939 and 1939–1940, are available from the Secretary-Treasurer. THE AMERICAN BIOLOGY TEACHER is indexed in EDUCATION INDEX.

are made as home-like as possible. During hibernation, the bats live in dark dens that are kept at a comfortable 40–42 degree temperature and a humidity of 92 percent. Drinking water is the animal's only requirement. When a bat goes into hibernation its heart slows down from 180 beats per minute to two or three. Its temperature drops from about 100 to the 40-degree temperature of its environment. For nourishment during its winter sleep, it draws on fat reserves and on the extra supply of glycogen stored in its liver. The Cornell scientists are investigating how the bat's carbohydrate metabolism changes to utilize this form of "animal starch," some of which exists in the livers and skeletal muscles of all animals. The unusual sex life of the hibernating bat is another subject. Mating takes place in the fall, but fertilization is delayed until spring. In the meantime the sperm are kept alive in the female's womb. Because the bats mate occasionally during hibernation, some observers have suggested that the autumn mating has no issue. But the Cornell group found that females isolated from males all winter still produced batlets in the spring.

Relatively little is known about hibernation, Professor Wimsatt explains, although the idea of suspended animation fascinates scientists and laymen alike. Much of the information from these studies, he adds, may some day be applicable to human beings too, because it concerns processes common to all mammals.

Prof. Thomas P. Fraser whose article, "Science Teaching for Better Living," which appeared in the March, 1954 issue writes to tell us of a correction that should be made in the background information appearing with the article. His degree is Ed.D., and the organization with which he is connected is the National Association for Research in Science Teaching.

Cancer has been formed within living membranes of experimental animals by compounds made from animal fats, three chemists of the Santa Barbara Cottage Hospital Research Institute, Santa Barbara, Calif., report.

New Editors Appointed for ABT

Dr. Richard Armacost and Mr. Paul Klinge by action of the Executive Board of the NABT have been appointed Co-Editors of the ABT beginning with the October 1954 issue. The co-editorship will succeed the temporary editorship of Mr. Klinge whose picture and biography have appeared in the October 1953 issue.

Dr. Armacost is an Associate Professor of Biological Education in the School of Science, Education, and the Humanities of Purdue University. His work there involves teaching genetics (one of his chief interests), general education biology, biology teaching methods, and working in the teacher training

Dr. Richard Armacost

program. He coordinates biology instruction in the four Purdue University Extension Centers in Indiana.

Since coming to Purdue in 1950, he has assisted high school science teachers and their administrators in a number of ways. His weekly radio program, "Ask the Biologist," is now available on tape recording and enjoys a wide circulation in Indiana. He is now producer of the Department of Biological Sciences' television programs. His Biology Teacher's Workroom at Purdue and his many visits to the secondary schools of the state have made him a well known figure to the science teachers of Indiana.

A native of Ohio, married, and an engaging personality, Dr. Armacost graduated as a botany major from Miami University and took his M.S. and Ph.D. in the same subject at the State University of Iowa. He taught at Syracuse University for ten years in various phases of botany, human genetics, and teacher education. He was an advisor in the graduate program there and developed a new course to improve the teaching proficiency of graduate students. Although he has been intensely interested in teacher training in the sciences, he is not the "stuffy, educator type."

He has been active in the promotion of the Indiana Science Talent Search, Regional and National Science Fairs, and the Purdue Sci-Math Assembly. He is a co-author of the General Science Handbook of the New York State Education Department and Editor of the Welch Biology and General Science Digest. While in New York he had a distinguished record of service to the cause of science teaching, serving in many capacities. He was president of the New York Science Teacher's Association in 1942–1943, and was Editor-elect of the N. Y. State Science Teacher's Journal at the time he came to Purdue. His long list of publications range from technical articles in botany to study guides and syllabi in the sciences. He has appeared in many national meetings as speaker, consultant, and section chairman.

"Dick" Armacost will prove to be a real asset in the improvement of biology teaching in the United States as Co-Editor of the ABT. His aim is to make the ABT a "good" magazine, an indispensable aid for teachers of the biological sciences.

PROVIDING BIOLOGICAL EXPERIENCES THROUGH A NATURE PROGRAM

LOUIS RZEPKA, Detroit, Michigan Public Schools

Today summer camping for children of elementary school age is a common experience for many boys and girls. Each summer there is a mass exodus of school children from the city to the country. Children living in industrialized urban centers have limited opportunities to become acquainted with the world of living things. Being suddenly transported out of an environment of asphalt and cement to what is sometimes considered a veritable wilderness of lakes, swamps, and forest, containing a variety of wild life, the child finds the natural environment of the camp an entirely new world, a world in need of meaningful interpretation.

Because of its location, a summer camp has an ideal opportunity to provide many new and meaningful experiences in the realm of biological phenomena through its nature program. A nature program planned and carried

with the children's present needs and past experiences in mind, can provide a variety of biological insights to supplement their school experiences and help them adjust to their new surroundings through an interpretation of the natural environment. However, instead of being a fact-centered program where children learn the names of 20 birds or 10 trees, the program should be centered around purposeful activities. Boys and girls of elementary school age like and want to do things, to share in group activities, and participate in real undertakings. This should be the central theme of the nature program, aimed at promoting those learning activities which will be most meaningful to the campers in fostering an "at home" feeling in the camp environment.

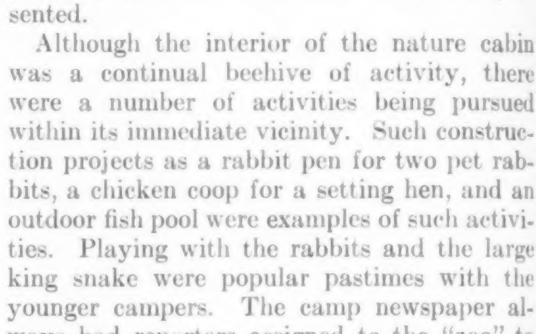
One of the first steps in the development of this "at home" feeling can be the recognition of some of the things in it, such as a frog, a tree, or an insect. Acquaintance can lead to friendliness as it is enriched through further experience. A child becomes acquainted with a snake or a toad as soon as he knows something about it. As an example, the actual experience of collecting an animal in its natural habitat, making a home for it, and finding out its basic needs through caring for it constitutes a real learning experience for the child. Such experiences, built one upon the other, enable the child not only to become intimately acquainted with many new forms of living things, but will serve to furnish the child with new insights as to the relationship of the natural environment to the variety of life it may contain. Of course, collecting and taking care of animals is but one example of the variety of biological experiences boys and girls can have through participation in nature activities.

At the Merrill Palmer School Camp, with which the author was associated as a staff member, the nature program was organized around four major areas. These areas were: (1) those activities carried on within the nature cabin; (2) activities carried on outside the nature cabin; (3) field trips on the camp grounds; (4) field trips away from camp.

The nature cabin or the "zoo" as the children called it, was a laboratory, museum, and workshop all combined into one. It was a laboratory where boys and girls found opportunities to talk about their everyday experiences, to observe phenomena such as the working of bees in the observation beehive, to carry on experimentation, such as feeding the king snake to see its constricting powers, and to arrive at conclusions resulting from their activities. The nature cabin was a workshop in that it provided opportunities for boys and girls to make things. Construction projects such as animal cages, insect and mineral collections, leaf prints, plaster plaques, bulletin boards, nature scrapbooks, and many others were continually in evidence. The nature cabin was a museum in that it had a variety of exhibits, specimens, and collections of a biological nature. However, this museum was not a dead museum where children just came to look, but rather it was alive in the true sense of the word. This museum was a place where children had their collections, their exhibits, and the animals which they collected and took care of. It was a museum in which children did not spend their time in passive inactivity, but rather a place where they could touch, feel, and handle the materials presented.

Although the interior of the nature cabin was a continual beehive of activity, there were a number of activities being pursued within its immediate vicinity. Such construction projects as a rabbit pen for two pet rabbits, a chicken coop for a setting hen, and an outdoor fish pool were examples of such activities. Playing with the rabbits and the large king snake were popular pastimes with the younger campers. The camp newspaper always had reporters assigned to the "zoo" to gather information about new additions to the "zoo" menagerie, exciting comments about the latest field trip, or some glimpse of coming events at the "zoo."

The third area of organization of the nature program was the field trip taken on the camp grounds. The camp environment consisted of approximately 140 acres of woodlands,


Fossil hunting.

Understanding comes through first-hand experiences.

swamps, meadows, and a lake. The field trip had three main objectives: (1) to collect biological specimens; (2) to familiarize the children with the entire camp in regard to its area, composition, and environment; and (3) to obtain specific information pertaining to some particular study a child may be undertaking, such as the location of a certain animal's habitat. The actual experience of observing a frog in its natural habitat, collecting it, making a compatible home for it, providing its basic needs, and then releasing it, was a true learning experience partly provided for by the field trip.

When a child first arrives at camp, it is of interest to watch him explore every nook and cranny within the immediate vicinity of his cabin. As his curiosity is satisfied he will begin to ask questions about the other areas of camp. This natural curiosity of children can be amply satisfied by the second purpose of the field trip, to give the campers new insights as to what lies over the next hill, where the swamps are, the camp boundaries, to whom neighboring farms belong, where the various roads lead, and so on. To some children who have a fear of the unknown, especially some of the younger campers to whom the camp is a world all of itself, the field trip through its exploratory activities can help to instill a sense of security. As the child becomes acquainted with the camp setting the need for adult security will vanish. The child can then take part in self-directed exploratory activities to further satisfy his curiosity.

The third purpose of the field trip was to secure specific information. Examples of such information would be to take a bird census or a biological census of the camp. At times a child was interested in a particular animal or plant about which he did not have too much information. The "zoo" library was first consulted to get the general information needed to pursue the study further. The next step was to plan a field trip to look for the animal's home or the animal itself. Most every camp, I am sure, has within its environs places of special interest to boys and girls. These may be a dairy farm, gravel pit, apiary, or a state park. There are many opportunities for learning experiences through planning field trips to places away from the camp.

A trip to a gravel pit can serve a variety of purposes. These may be to provide new insights as to the geological history of the camp's location, its relationship to the people living near it, or the ultimate use of its products. A trip to a nearby farm or a apiary can be of immeasurable value, having the opportunity to milk a cow, or to observe the processing of honey in its various stages from the comb to the finished product, will linger in the child's memory long after the camp season comes to a close. Field trips, if planned and carried out with a definite purpose, can play an important part in the ultimate success of the nature program.

A word or two should be said about using "resource persons" as part of the nature program. If the camp is located near a small community, there is usually someone who has a special interest in some phase of nature study and who would be willing to share this interest with the campers. Such possibilities should be capitalized on to further enrich the program. An example of such a resource person was a well-known wildlife illustrator who was invited to visit the camp. He not only came out to talk to the boys and girls about his work, but he also brought out many of his paintings which had been published in national magazines and textbooks dealing with mammal and bird life. The children had the opportunity not only to see a practical application of an interest in nature but were also

Talking to an expert. Richard Grossenheider, well-known wild-life illustrator, discusses his paintings.

able to appreciate more fully the various activities which they were carrying on.

These are just a few ideas about one way in which so-called "school learning" in the life sciences can be carried over into a camp situation for the express purpose of developing biological concepts with elementary school children. However, we are still a long way from what I consider the goal to be strived for by workers in this field. The goal is the development of a *conscious willingness from within* on the part of the campers to want to pursue the study of nature because of its intrinsic interest to them. I believe we have to a large measure succeeded in this endeavor in past nature programs at Merrill Palmer.

"BIOLOGY IN THE NEWS"

Tracking the Killer, Robert Coughlan, *Life*, Feb. 22, 1954, pp. 120–135.

This account of some of the scientists and events which have led to the development of the new polio vaccine brings home the necessity and effectiveness of teamwork among the great number of persons who cooperated in its development. For your better students.

Guide to a Beautiful Lawn and Garden, Thomas H. Everett, *Today's Woman*, March 1954, pp. 53–66.

A helpful and attractive handbook on how to plan your yard; what to do with what is there; and what you can plant. Also, many do's and don't's for a pleasing carpet of lawn grass.

Danger in Your Dinner, Ruth and Edward Brecher, *Redbook*, March 1954, pp. 28–31, 94–95.

Pork from hogs fattened on raw garbage is dangerous. Although 1% of our hogs are fed raw garbage the chances of becoming infected with trichina worms is one in six. Certain means to stop this menace are discussed.

Teen-Agers Do Not Eat Right, Frederick J. Stare, M.D. and Julia A. Shea, M.S., *McCall's*, March 1954, p. 100.

This short article can start a lot of discussion among the girls and boys in your classes. More provocative than informative.

Farming Your Forest, Donald Culross Peattie, *Country Gentleman*, March 1954, pp. 34–35, 66–69.

Tree farmers are learning that woodlands, properly cared for, yield rich annual harvests. The American Tree Farm System is ready to help anyone with land and a will to manage it according to the best principles of forestry.

New Control for High Blood Pressure, J. D. Ratcliff, *Collier's*, March 5, 1954, pp. 58–61.

High blood pressure is responsible for many deaths and thousands of invalids. Research with some of the little known drugs has resulted in alleviating the condition and returning many disabled victims to normal and useful life.

Those Homemade Apple Trees, Frank L. Taylor, *Sat. Ev. Post*, Feb. 27, 1954, pp. 32–33, 114–116.

Desirable kinds of apples often appear suddenly. How the Starks of Missouri find such mutants and reproduce them in quantity makes interesting reading.

What Is a Lobster?, Harry Botsford, *Coronet*, March 1954, pp. 162–164.

A short account of the growth and habits of the lobster.

Your Corner Drugstore, Lawrence Elliot, *Coronet*, March 1954, pp. 36–40.

The drugstore is considered not only as a dispenser of prescriptions but also as the town's bureau of first aid and social welfare.

Iron-Plated Tinhorn, Jack O'Connor, *Outdoor Life*, March 1954, 42–43, 127–130.

The rhinoceros comes out second best with the modern hunter. In this account of the killing of the rhinoceros the author credits the animal with little intelligence.

The Panther Prowls the East Again!, Herbert Ravenel Sass, *Sat. Ev. Post*, March 13, 1954, pp. 31, 133–136.

For nearly 100 years panthers have not been seen in the mountains of Eastern United States. Now they are back again according to many eyewitness accounts though none has been killed.

Books For Busy Biologists

SMITH, PHILIP E., and COPENHAVER, WILFRED M. *Bailey's Textbook of Histology.* 13th Ed. The Williams and Wilkins Co., Baltimore, Md. xviii + 775 pp. illus. 1953. $9.00.

The authors have made an extensive revision of Bailey's well-known and widely used textbook, written primarily for students of medicine and dentistry. Gross anatomy and physiological functions of various body structures are discussed along with microscopic anatomy, to facilitate significant correlations by instructors and their students. Correlations with pathology are also emphasized. Six new color plates and 88 halftones and line diagrams have been added. Many parts of the text matter have been rewritten for increased clarity, and to bring them up-to-date. In this, as in the previous 8th through 12th editions, the authors have made further significant contributions to and changes in an already standard text and reference book for college microtechnique and histology

classes. The book would serve also as an excellent technical reference work for teachers of the life sciences at the secondary school level.

B. Bernarr Vance,
The University of Dayton, Ohio

Northern, Henry T., and Northern, Rebecca. *The Secret of the Green Thumb.* Ronald Press, 15 E. 26th St., New York 10, New York. x + 431 pp. illus. 1954. $5.00.

In non-technical language, the authors explain many of the scientific foundations for approved practices in the planting, propagation, and care of vegetable and flower garden plants, lawns, shrubs, and trees, and apply these principles to typical problems of the gardener, farmer, plant hobbyist, and nurseryman. Many new techniques of plant breeding and chemical treatment of plants are outlined and explained. Bacteria, viruses, and fungi in general are correlated with other plants both as beneficial and harmful organisms. Over 200 illustrations add to the effectiveness of the text matter. The index is complete and well-organized. The authors combine scientific accuracy and practicality in a book which can supply inspiration and much information for discussions and interesting projects in life science classes, biology and garden clubs, and hobby groups.

B. Bernarr Vance,
Kiser High School, Dayton 4, Ohio

Shrader, Franz. *Mitosis.* 2nd ed. Columbia Univ. Press, New York. xii + 170 pp. illus. 1953. $4.00.

This is an authoritative reorientation of modern views on mitosis. Facts are presented in a readable and interesting style, and hypotheses are handled scientifically. Topical emphasis shows good balance, the text matter is clear and concise, and the bibliography is quite comprehensive and complete. The index is well arranged.

Olive R. Marcum,
The University of Dayton

Pinner, Erna. *Curious Creatures.* Philosophical Library, Inc., New York. 256 pp. illus. 1953. $4.75.

Interesting yet brief descriptions and drawings of many curious forms of animal and plant life are arranged under broad chapter headings such as, "The Struggle for Food," "Symbiosis and Parasitism," "A Parade of Curiosities," etc. The information is accurate and, except for a few typographical errors, well-stated and worded in an intriguing and absorbing manner. The author's travel experiences and personal observations lend a convincing element of authenticity and reality to her descriptions and drawings. The index is brief but comprehensive.

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Kiser High School, Dayton 4, Ohio

Bio-Buy-Lines

PATTEN, BRADLEY M. *Human Embryology.* 2nd Ed. The Blakiston Co., Inc., New York. xvii + 798 pp. illus. 1953. $5.00.

In this revised edition of an authoritative and widely recognized textbook of human embryology, the discussions in Chapters 4 and 6, dealing with very early human embryos, has been expanded and rewritten from careful study of new human material. Extensive changes also have been made in the text matter on embryonic development of the heart and larger blood vessels, offering to the student a broader and more complete background for understanding newer techniques in cardiovascular surgery and treatment. The extensive bibliography of the 1st edition has been supplemented with an up-to-date listing of more recent reference material, especially material relating to the cardiovascular system.

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